Amendments to the Claims

1. (Currently Amended) A process for depositing a zincate coating on aluminum or aluminum based alloy substrates which comprises

(A) immersing an aluminum or aluminum based alloy substrate in an aqueous alkaline zincate solution comprising hydroxide ions, zinc ions, nickel and/or cobalt ions, iron ions, copper ions and at least one inhibitor containing one or more nitrogen atoms, one or more sulfur atoms, or both sulfur and nitrogen atoms provided said nitrogen atoms are not present in an aliphatic amine or hydroxylamine and the inhibitor is selected from the group consisting of nitrogen-containing disulfides; alkali metal thiocyanates; thiocarbamates; nitrogen-containing heterocyclic compounds; mercapto substituted nitrogen-containing heterocyclic compounds; thioacids; thioalcohols; compounds characterized by the formula

$$R_2N\text{-}C(S)Y \qquad I$$

wherein each R is independently hydrogen or an alkyl, alkenyl, or aryl group, and Y is XR^1, NR_2 or $N(H)NR_2$; wherein X is O or S and R^1 is hydrogen or an alkali metal; and mixtures thereof for a period of time sufficient to deposit the desired coating, and

(B) removing the coated substrate from the zincate solution.

2. (Original) The process of claim 1 wherein the surface of the aluminum or aluminum based alloy is cleaned, etched and desmutted prior to immersion in the zincate solution.

3. (Original) The process of claim 2 wherein the cleaning is performed with an alkaline cleaner, and the etching is performed with an alkaline or acid etching solution.

4. (Original) The process of claim 1 wherein after immersion in the zincate solution to form a first zincate coating, the coated aluminum or aluminum alloy is withdrawn from the zincate solution, the coating is at least partially stripped with acid, and the aluminum or aluminum alloy is re-immersed in the zincate solution to form a second zincate coating.

5. (Original) The process of claim 4 wherein the aluminum or aluminum alloy is rinsed with water after each of the cleaning, etching, desmutting, zincating and stripping with acid steps.

6. (Original) A zincate coated aluminum or aluminum alloy obtained in accordance with the process of claim 1.

7. (Currently Amended) A process for depositing a zincate coating on aluminum or aluminum based alloy substrate which comprises

(A) immersing the substrate in an aqueous alkaline zincate solution comprising hydroxide ions, zinc ions, nickel and/or cobalt ions, iron ions, copper ions, nitrate ions, at least one inhibitor containing nitrogen atoms, sulfur atoms, or both sulfur and nitrogen atoms provided said nitrogen atoms are not present in an aliphatic amine or aliphatic hydroxylamine, and the inhibitor is selected from the group consisting of nitrogen-containing disulfides; alkali metal thiocyanates; thiocarbamates; nitrogen-containing heterocyclic compounds; mercapto substituted nitrogen-containing heterocyclic compounds; thioacids; thioalcohols; compounds characterized by the formula

$$R_2N\text{-}C(S)Y \qquad I$$

wherein each R is independently hydrogen or an alkyl, alkenyl, or aryl group, and Y is XR^1, NR_2 or $N(H)NR_2$; wherein X is O or S and R^1 is hydrogen or an alkali metal; and

mixtures thereof and at least one metal complexing agent for a period of time sufficient to deposit the desired coating, and

(B) removing the coated substrate from the zincate solution.

8. (Original) The process of claim 7 wherein the surface of the substrate is cleaned, etched and desmutted prior to immersion in the zincate solution.

9. (Original) The process of claim 8 wherein the cleaning is performed with an alkaline cleaner, and the etching is performed with an alkaline or acid etching solution.

10. (Original) The process of claim 7 wherein after immersion in the zincate solution to form a first zincate coating, the coated substrate is withdrawn from the zincate solution, the coating is at least partially stripped with acid, and the aluminum or aluminum alloy is re-immersed in the zincate solution to form a second zincate coating.

11. (Original) The process of claim 10 wherein the substrate is rinsed with water after each of the cleaning, etching, desmutting, zincating and stripping with acid steps.

12. (Original) A zincate coated aluminum or aluminum alloy obtained in accordance with the process of claim 7.

13. (Currently Amended) A process for depositing a zincate coating on aluminum or aluminum based alloy substrate which comprises

(A) immersing the substrate in an aqueous alkaline zincate solution comprising:

from about 5 to about 300 g/l of hydroxide ions,

from about 1 to about 30 g/l of zinc ions,

from about 0.1 to about 5.0 g/l of iron ions,

from about 0.01 to about 10 g/l of copper ions,

from about 0.05 to about 20 g/l of nickel and/or cobalt ions,

from about 0.001 to about 10 g/l of an inhibitor selected from the group consisting of nitrogen-containing disulfides; alkali metal thiocyanates; thiocarbamates; nitrogen-containing heterocyclic compounds; mercapto substituted nitrogen-containing heterocyclic compounds; thioacids; thioalcohols; compounds characterized by the formula

$$R_2N\text{-}C(S)Y \qquad I$$

wherein each R is independently hydrogen or an alkyl, alkenyl, or aryl group, and Y is XR^1, NR_2 or $N(H)NR_2$; wherein X is O or S and R^1 is hydrogen or an alkali metal; and mixtures thereof

from about 0.01 to about 10 g/l of an alkali metal nitrate, and

from about 1 to about 250 g/l of at least one metal complexing agent

for a period of time sufficient to deposit the desired coating, and

(B) removing the coated substrate from the zincate solution.

14. (Original) The process of claim 13 wherein the surface of the substrate is cleaned, etched and desmutted prior to immersion in the zincate solution.

15. (Original) The process of claim 14 wherein the cleaning is performed with an alkaline cleaner, and the etching is performed with alkaline or acid etching solution.

16. (Original) The process of claim 13 wherein after immersion in the zincate solution to form a first zincate coating, the coated substrate is withdrawn from the zincate solution, the coating is at least partially stripped with acid, and the aluminum or aluminum alloy is re-immersed in the zincate solution to form a second zincate coating.

17. (Original) The process of claim 16 wherein the substrate is rinsed with water after each of the cleaning, etching, desmutting, zincating and stripping with acid steps.

18. (Original) A zincate coated aluminum or aluminum alloy obtained in accordance with the process of claim 11.

19. (Currently Amended) A process for depositing a metal coating on an aluminum or aluminum alloy substrate comprising

(A) applying an immersion zincate coating on the substrate by immersing the substrate in an aqueous alkaline zincate solution comprising hydroxide ions, zinc ions, nickel and/or cobalt ions, iron ions, copper ions and at least one inhibitor containing one or more nitrogen atoms, one or more sulfur atoms, or both sulfur and nitrogen atoms provided said nitrogen atoms are not present in an aliphatic amine or hydroxylamine, and the inhibitor is selected from the group consisting of nitrogen-containing disulfides; alkali metal thiocyanates; thiocarbamates; nitrogen-containing heterocyclic compounds; mercapto substituted nitrogen-containing heterocyclic compounds; thioacids; thioalcohols; compounds characterized by the formula

$$R_2N\text{-}C(S)Y \qquad I$$

wherein each R is independently hydrogen or an alkyl, alkenyl, or aryl group, and Y is XR^1, NR_2 or $N(H)NR_2$; wherein X is O or S and R^1 is hydrogen or an alkali metal; and mixtures thereof

(B) plating the zincate coated substrate using an electroless or eletrolytic metal plating solution.

20. (Original) The process of claim 19 wherein the surface of the substrate is subjected to alkaline cleaning, acid etching and desmutting, prior to immersion in the zincate solution.

21. (Original) The process of claim 20 wherein the cleaning is performed with an alkaline cleaner, and the etching is performed with alkaline or acid etching solution.

22. (Original) The process of claim 19 wherein after immersion in the zincate solution to form a first zincate coating, the coated substrate is withdrawn from the zincate solution, the coating is at least partially stripped with acid, and the aluminum or aluminum alloy is re-immersed in the zincate solution to form a second zincate coating.

23. (Original) The process of claim 22 wherein the substrate is rinsed with water after each of the cleaning, etching, desmutting, zincating and stripping with acid steps.

24. (Original) A metal coated aluminum or aluminum alloy obtained in accordance with the process of claim 19.

25. (New) The process of claim 1 wherein the inhibitor is a thiourea compound represented by the formula:

$$[R_2N]_2CS \qquad II$$

wherein each R is independently hydrogen or an alkyl, alkenyl or aryl group.

26. (New) The process of claim 1 wherein the inhibitor is a thiocarbamate represented by the formula:

$$R_2NC(S)\text{-}XR^1 \qquad III$$

wherein each R is independently hydrogen, or an alkyl, alkenyl or aryl group, X is O or S, and R^1 is hydrogen or an alkali metal.

27. (New) The process of claim 1 wherein the inhibitor is a thiosemicarbazide represented by the formula

$$R_2N\text{-}C(S)\text{-}N(H)NR_2 \qquad IV$$

wherein each R is independently hydrogen, or an alkyl, alkenyl or aryl group.

28. (New) The process of claim 1 wherein the inhibitor is a disulfide compound having the formula:

$$[R_2NCS_2]_2 \qquad V$$

wherein each R is independently hydrogen, or an alkyl, alkenyl or aryl group.

29. (New) The process of claim 1 wherein the inhibitor is at least one nitrogen containing heterocyclic compound or mercapto substituted nitrogen containing heterocyclic compound, or mixtures thereof, and the heterocyclic compound is selected from pyrroles, imidazoles, benzimidazoles, pyrazoles, triazoles, pyridines, piperazines, pyrazines, piperidines, pyrimidines, thiazoles, thiazolines, thiazolidines, rhodanines, and morpholines.

30. (New) The process of claim 1 wherein the inhibitor is a mercapto substituted nitrogen containing heterocyclic compound.

31. (New) The process of claim 1 wherein the solution also contains one or more metal complexing agents.

32. (New) The process of claim 1 wherein the zincate solution (A) is free of cyanide ions.

33. (New) The process of claim 1 wherein the zincate solution (A) also contains nitrate ions.

34. (New) The process of claim 7 containing, as a metal complexing agent, an aliphatic amine, an aliphatic hydroxylamine, or mixtures thereof.

35. (New) The process of claim 7 containing, as a metal complexing agent, an acetate, citrate, glycollate, lactate, maleate, pyrophosphate, tartrate, gluconate, or glucoheptonate, and mixtures thereof.

36. (New) The process of claim 7 wherein the inhibitor is a thiourea compound represented by the formula:

$$[R_2N]_2CS \qquad II$$

wherein each R is independently hydrogen or an alkyl, alkenyl or aryl group.

37 (New) The process of claim 7 wherein the inhibitor is a disulfide compound having the formula:

$$[R_2NCS_2]_2 \qquad V$$

wherein each R is independently hydrogen, or an alkyl, alkenyl or aryl group.

38. (New) The process of claim 7 wherein the inhibitor is at least one nitrogen containing heterocyclic compound or a mercapto substituted nitrogen containing heterocyclic compound, or mixtures thereof and the heterocyclic compound is selected from pyrroles, imidazoles, pyrazoles, triazoles, tetrazoles, thiazoles, thiazolines, thiazolidines, pyridines, piperazines, pyrazines, piperidines, pyrimidines, and morpholines.

39. (New) The process of claim 7 wherein the zincate solution (A) is free of cyanide ions.

40. (New) The process of claim 38 wherein the inhibitor is a mercapto substituted nitrogen containing heterocyclic compound.